or if they move eastward leave vigorous secondaries over the lower latitudes, and (2) that when the axis of the oceanic HIGH assumes the direction above described, if a Plateau HIGH exists at the same time it will disappear or be greatly vitiated in from 12 to 36 hours, no matter how intense it may appear to be. For instance, on the 10th the reduced pressure at Winnemucca was 30.52 inches. Twenty-four hours later a disturbance which had been centered near Cordova, Alaska, was over central Canada and the pressure at Winnemucca had fallen to 30.04 inches, while within another 24-hour period an independent LOW was located over Utah and rain had fallen in the Pacific Forecast District as far south as the Mexican border.

These incidents were, in a general way, repeated in the series of charts beginning on December 20th when, with a LOW centered over southeastern Alaska, a HIGH over Nevada rapidly disappeared, the pressure at Winnemucca falling from 30.24 inches on the date in question to 29.62 inches 24 hours later, and precipitation covering the Pacific States from the northern to the southern border within the same period. During the inclusive period mentioned, numerous storm warning displays were made on the north coast and occasionally over Puget Sound, namely, on the 10th, when warnings were ordered for the Washington coast, on the 14th for all points in Oregon and Washington, on the 17th for the northern California coast and on the 20th and 23d for all Washington and Oregon stations. In all cases the warnings were justified by subsequent winds in some part of the area specified, except in the case of those on the 14th which were attended by an anomalous absence of gale phenomena, considering the fact that pressure developments took place about as expected.

On the 26th a reversion to the southwest-northeast type of isobar occurred in the oceanic HIGH, which was immediately followed by the accumulation of high pressure over the Plateau and Rocky Mountain region and which persisted until the close of the month. Gale warnings were displayed on the 26th, 27th, 29th, 30th, and 31st for northern ports, all of which were followed by stong winds or gales in some part of the area affected.

The storm referred to as moving southeastward from Alaska on the 10th was followed by a southeastward movement of a great body of high pressure from polar regions which reached the North Pacific States on the 13th, requiring cold-wave warnings for eastern Washington and northern Idaho on the 12th. Advices of the approach of a general cold period were also sent to other parts of the forecast district which it was known would be affected, and the public was adequately forewarned.

Frequent frosts characterized the month in California and general warnings were issued for all or parts of that State on 19 dates. The most noteworthy were those which were followed by more or less general firing in the citrus districts on the 25th, 27th, 28th, and 29th.—*T. R. Reed.*

RIVERS AND FLOODS

By H. C. FRANKENFIELD

The outstanding features of river regime during the month were the general and disastrous floods in the Southern streams tributary to the Ohio River, an unprecedented occurrence within the last 54 years. Only twice within this period (the floods of 1926 excluded), has the flood stage in the Upper Tennessee River been exceeded by a significant amount (39.5 feet at Chattanooga, Tenn., on December 31, 1901, and 34.4 feet on December 21, 1915). The lower Tennessee and the Cumberland Rivers have been entirely free from floods of consequence.

Cumberland River.—A period of moderate to heavy rains from December 8 to 13 was attended by marked rises in the rivers, and before the usual decline could be accomplished, another period of excessive rains came on (December 20 and 21), and a second and much more rapid rise set in. Over the drainage area of the Cumberland River, the average rainfall was a little over 4.25 inches, and flood warnings were indicated at once. Thus far creast stages only a few feet above the flood stages were indicated; in other words, moderately high floods only. Unfortunately, on December 24, another two-day heavy rain period began (average about 3.50 inches), and, as a matter of course, the flood conditions became greatly intensified. On December 25 additional warnings were issued for further rises of about 8 feet in a river already above flood stage. These second warnings were closely verified as to stage and time, and would have marked the crests of the flood had not another rain of about 1.50 inches fallen on December 27 and 28. Again more water was indicated and again warnings were revised to meet a situation that was already most grave, dangerous, and destructive. Not more than a foot or two of additional rise could occur above Nashville, but at and below that city a further increase of 3 or 4 feet was inevitable.

The table at the end of this report shows the crest stages reached. As a whole, the flood will rank in importance with that of January, 1882. The flood of 1926 was greater between Carthage and Nashville, Tenn., and may finally be determined to be greater in its entirety. This will be determined by a resurvey of several high-water marks of 1882.

Flood damage was most serious between Carthage and Nashville, and reliable estimates of its extent were unobtainable. Many persons, of the opinion that a repetition of the flood of 1882 was impossible, and especially at this time of the year, had done considerable building and had stored valuable property within the range of the flood waters to such an extent that it could not be moved within a reasonable time. Moreover, it was reported that much loss was due to the fact that many persons failed to heed the warnings for abnormally high water. It must be admitted also that considerable loss was occasioned through the fact that the earlier forecasts were not sufficiently broad. This can hardly be termed a failure of commission, as the coming of additional heavy rains added complications that could not be foreseen at the time the forecasts were made.

Two lives were lost during the flood, both in Nashville. Very incomplete reports of loss and damage are as follows:

(1) Tangible property	$454,342
(2) Crops	441,300
(3) Livestock	68,300
(4) Suspension of business, etc	113,135
Total	1,077,077

Other estimates exceeded this total, the Nashville Banner estimating the losses in Nashville and vicinity alone at $1,500,000. The reported value of property saved through the warnings of the Weather Bureau was $1,207,850.

Newspaper reports indicate that at least 5,000 people in Nashville and 4,000 in other places were forced to abandon their homes. Much of the city of Nashville, especially East Nashville was under water, and at one

point the river was said to have been three miles in width.

Tennessee River.—The flood began about December 25, and the crest had just about reached Florence, Ala., at the end of the month. A complete account of this flood will appear in the Monthly Weather Review for January, 1927. A report of the Green River flood will also appear at that time.

Kentucky River.—These floods also owe their origin to the heavy rains of December 20–21 and were also augmented by the later rains. Warnings were issued on December 21, and again on December 22 and 25, but the later warnings failed of distribution over the mountainous sections of the upper river on account of complete interruption of communication, a fact that also prevented the transmission of important information from up-river stations to the district center at Louisville, Ky. The crest stages occurred on December 25 and 26, and the crest of 34.8 feet at High Bridge, Ky., exceeded that of March 27, 1913, by 0.2 foot.

Losses were not very heavy, a total of only $43,000 being reported, while much personal property and merchandise was saved through the warnings.

Other Rivers of Kentucky and West Virginia.—There were two rises, both moderate, one on December 22, and the other on December 26–28. Flood stages were approximated only, and there was little or no damage, although there was a little local flooding in Williamson, W. Va., from backwaters of the Tug Fork of the Big Sandy River through the city sewers.

Ohio River.—There were corresponding rises in the Ohio River but none of much consequence above Cincinnati, Ohio. The nearest approach to flood conditions was below the mouth of the Kentucky River, and from Cloverport, Ky., to Shawneetown, Ill., the Ohio River was in moderate flood, beginning with December 28, and was approaching the flood stage at points below, the gage at Cairo, Ill., reading 44 feet on December 31, while New Madrid, Mo., on the Mississippi River, reported 33.3 feet. Report on this flood will also be made later.

Atlantic drainage.—Nothing of special interest transpired. There were small local floods in the rivers of southern Virginia, eastern North Carolina, and central and western South Carolina. These floods were well forecast and no damage was reported.

East Gulf drainage.—There was a moderate flood in the Coosa and Cahaba Rivers of Alabama during the closing days of the month. The heavy general rains heretofore referred to were responsible for the floods, which were not sufficient to bring the Alabama River to flood stage. Local warnings were issued at the proper time. The following comment was made by Mr. P. H. Smyth, official in charge of the Weather Bureau Office, Montgomery, Ala.

The rains during the period mentioned were only moderate in the Tallapoosa basin, and the rain which fell above upper Tallassee was held in Martin Lake, above Martin Dam. No water from Martin Lake entered the Tallapoosa River below Martin Dam except that which passed through the turbines of the power plant at the dam.

Martin Lake has a storage capacity of seventy (70) billion cubic feet. On January 1, 1927, there were stored twenty-three (23) billion cubic feet of water, and it is believed therefore that the stream flow of the Tallapoosa River below Tallassee will be practically constant during the spring of 1927, as far as the rainfall above Martin Dam is concerned.

During the rise the power plants of the Alabama Power Co. at Lock No. 12, and Mitchell Dam, Coosa River, 69 and 57 miles, respectively, above Montgomery, Ala., were so operated as to regulate the stream flow, and consequently the stages reached at places below the dams were much lower than they otherwise would have been.

The Weather Bureau Office at Montgomery kept in touch with the operating department of the Alabama Power Co. through the Montgomery branch, and being governed by the information received, issued no flood warnings for places on the lower Coosa and upper Alabama Rivers. The information received from the power company was of much value to persons on the upper Alabama who had cattle and stock in the lowlands, as they were saved unnecessary expense and trouble of moving them.

The flood in the Tombigbee and Black Warrior Rivers of Alabama and Mississippi was more serious and was still in progress at the close of the month. Report will be made later.

The floods in the rivers of the Pascagoula system of Mississippi were more moderate and Pearl River only was in flood. This flood continued at the end of the month, as did also the flood in the Yazoo River of Mississippi. The latter flood was very severe over the upper reaches.

Illinois River.—The Illinois River fell below the flood stage of 12 feet at Pearl, Ill., during December 27, marking the end of the flood that had prevailed since the early days of September, 1926. This flood was discussed in the MONTHLY WEATHER REVIEW for October, 1926.

Local floods in the Little Red and Petit Jean Rivers of Arkansas were not of consequence. However, warnings of a decided rise were distributed along the White River from Calico Rock southward in time to permit the removal of livestock from the bottoms. Some corn and cotton inside the levees were destroyed.

An important flood occurred in the upper Ouachita Basin of southwestern Arkansas during the last decade of the year. An average rainfall on December 20–21 of 4.57 inches, followed by several days of substantial rains, caused this flood which at Camden, Ark., reached a stage of 38.5 feet, 8.5 feet above the flood stage, at 6 p. m., December 25. Warnings were first issued on December ber 21.

A woman was drowned in the Little Missouri River near Prescott, Ark., and the reported loss and damage aggregated $75,850, of which $14,850 was in farm property and livestock. The greater losses occurred along the Little Missouri River and the Ouachita River in the vicinity of Arkadelphia, Ark. A considerable quantity of livestock was saved through the warnings.

The same general and heavy rains caused floods in the Little River of Arkansas and Sulphur River of Texas. There was also a decided rise in the Red River, but no approach to flood stage, except at Fulton, Ark., where the crest stage of 27.5 feet on December 25, was only 0.5 foot below the flood stage. Ample warnings, beginning with December 21, were issued for these floods, and the reported value of property saved was $33,000, not including the Red River proper, for which no figures could be obtained. The total of the reported losses was $25,350.

Trinity River of Texas.—The Trinity River was in moderate flood at Trinidad, Tex., from December 23, 1926, to January 1, 1927, and at Liberty, Tex., from December 28 to 31. Timely warnings permitted the saving of all movable property.

Ice service.—On December 20, 1926, there was inaugurated over the Ohio River Basin, the Missouri River east of Kansas City, Mo., and the Mississippi River from the mouth of the Missouri to the mouth of the Ohio, a daily ice reporting service, mainly in the interest of navigation but also for the benefit of other interests that might be affected by ice conditions. Through an interlocking telegraph system, daily reports are exchanged between Weather Bureau stations, reports received from sub-

stations, and a daily ice summary and forecast issued through the medium of bulletins, radio, telegraph, telephone and newspapers. It is hoped and expected that the new service will be of great value to those interested.

River and station	Flood stage	Above flood stages—dates		Crest	
		From—	To—	Stage	Date
ATLANTIC DRAINAGE					
	Feet			*Feet*	
Saluda: Chappells, S. C.	14	30	30	14.3	30
James: Columbia, Va.	18	27	28	21.0	28
Roanoke: Weldon, N. C.	30	29	(1)	35.7	30
EAST GULF DRAINAGE					
Coosa: Gadsden, Ala.	22	28	(1)	23.9	29
Cahaba: Centerville, Ala.	25	26	26	26.5	26
Black Warrior: Lock, No. 10, Tuscaloosa, Ala.	46	25	(1)	61.8	26
Tombigbee:					
Aberdeen, Miss.	33	25	(1)	39.2	27
Columbus, Miss.	33	27	31	34.4	28
Lock, No. 4, Demopolis, Ala.	39	26	(1)	66.3	Jan. 5
Pearl:					
Edinburg, Miss.	21	31	(1)	(2)	
Jackson, Miss.	20	30	(1)	(2)	
MISSISSIPPI DRAINAGE					
Ohio:					
Dam, No. 44, Leavenworth, Ind.	48	28	(1)	50.8	30–31
Cloverport, Ky.	40	28	(1)	42.8	31
Evansville, Ind.	35	27	(1)	(2)	
Dam, No. 48, Cypress, Ind.	35	28	(1)	(2)	
Mount Vernon, Ind.	35	28	(1)	(2)	
Shawneetown, Ill.	35	29	(1)	(2)	
Guyandotte: Logan, W. Va.	20	22	22	20.2	22
Big Sandy, Levisa Fork: Pikeville, Ky.	35	22	22	41.3	22
Kentucky:					
Hazard, Ky.	20	21	21	25.0	21
Beattyville, Ky.	30	22	23	40.1	22
		26	26	30.6	26
High Bridge, Ky.	30	25	27	34.8	26
Frankfort, Ky.	31	25	29	36.0	26
Green-Big Barren:					
Bowling Green, Ky.	20	22	29	36.5	23
Munfordville, Ky.	28	23	28	36.9	24
Lock, No. 6, Brownsville, Ky.	30	23	(1)	42.5	26
Lock, No. 4, Woodbury, Ky.	33	22	(1)	49.3	27
Lock, No. 2, Rumsey, Ky.	34	25	(1)	42.3	31
Cumberland: Williamsburg, Ky.	22	22	29	26.5	26
Burnside, Ky.	50	22	23	56.3	22
		25	27	59.3	26
Celina, Tenn.	45	23	Jan. 2	57.2	29
Carthage, Tenn.	40	23	Jan. 4	59.1	30
Nashville, Tenn.	40	22	Jan. 7	56.2	Jan. 1
Clarksville, Tenn.	46	22	Jan. 9	60.0	Jan. 2
Lock, F, Eddyville, Ky.	57	26	Jan. 11	68.5	Jan. 5
Tennessee:					
Knoxville, Tenn.	12	26	30	14.0	29
Rockwood, Tenn.	20	25	30	25.2	27
Chattanooga, Tenn.	33	26	(1)	38.4	29–30
Bridgeport, Ala.	24	27	(1)	28.3	30
Guntersville, Ala.	31	27	(1)	38.3	30
Decatur, Ala.	21	29	(1)	23.2	Jan. 1
Florence, Ala.	18	25	(1)	26.6	29
Riverton, Ala.	33	25	(1)	(2)	
Savannah, Tenn.	40	27	(1)	(2)	
Johnsonville, Tenn.	31	27	(1)	(2)	
Holston, N Fork: Mendota, Va.	8	22	22	16.2	22
Big Pigeon:					
Newport, Tenn.	6	26	26	7.3	26
		29	29	6.2	29
Rogersville, Tenn.	14	23	23	15.0	23
Clinch:					
Speers Ferry, Va.	20	22	22	22.0	22
Clinton, Tenn.	25	23	28	32.3	24
Little Tennessee: McGhee, Tenn.	20	26	26	20.2	26
Hiwassee: Charleston, Tenn.	22	29	29	22.9	29
Elk: Fayetteville, Tenn.	14	24	(1)	25.8	28
Duck: Columbia, Tenn.	30	25	30	35.6	27
Illinois:					
Henry, Ill.	10	(3)	16	14.5	Nov. 22
Peru, Ill.	14	(3)	26	19.9	Nov. 19
Peoria, Ill.	18	(3)	11	21.0	Nov. 23–24
Havana, Ill.	14	(3)	27	18.6	Nov. 28–30
Beardstown, Ill.	14	(3)	31	20.4	Nov. 29–30
Pearl, Ill.	12	(3)	27	16.4	Nov. 30
Black: Corning, Ark.	11	23	(1)	(2)	
Little Red: Dam, No. 1, Judsonia, Ark.				30.0	22–23
Arkansas: Yancopin, Ark.	29	25	(1)	(2)	
Tallahatchie: Swan Lake, Miss.	25	30	(1)	(2)	
Yazoo: Greenwood, Miss.	36	30	(1)	(2)	
Sulphur:					
Ringo Crossing, Tex.	20	21	26	27.1	22
Finley, Tex.	24	24	(1)	29.0	26
Little: Whitecliffs, Ark.	28	23	25	28.9	24
Ouachita:					
Arkadelphia, Ark.	18	22	23	22.5	22
Camden, Ark.	30	24	(1)	38.5	25
WEST GULF DRAINAGE					
Trinity:					
Trinidad, Tex.	28	23	23	28.0	23
		25	Jan. 1	30.9	29–30
Liberty, Tex.	25	28	31	25.4	28

[1] Continued at end of month.
[2] Crest occurred after end of month.
[3] Continued from last month.
[4] Estimated.

MEAN LAKE LEVELS DURING DECEMBER, 1926

By UNITED STATES LAKE SURVEY

[Detroit, Mich., January 4, 1927]

The following data are reported in the "Notice to Mariners" of the above date:

Data	Lakes [1]			
	Superior	Michigan and Huron	Erie	Ontario
Mean level during December, 1926:	*Feet*	*Feet*	*Feet*	*Feet*
Above mean sea level at New York	601.68	578.26	571.45	245.42
Above or below—				
Mean stage of November, 1926	−0.07	+0.04	−0.07	+0.18
Mean stage of December, 1925	+1.43	+0.72	+1.06	+0.87
Average stage for December, last 10 years	−0.34	−1.35	−0.08	+0.23
Highest recorded December stage	−1.45	−4.32	−2.08	−2.19
Lowest recorded December stage	+1.43	+0.72	+1.06	+1.99
Average departure (since 1860) of the December level from the November level	−0.27	−0.22	−0.08	−0.09

[1] Lake St. Clair's level: In December, 1926, 574.05 feet.

EFFECT OF WEATHER ON CROPS AND FARMING OPERATIONS, DECEMBER, 1926

By J. B. KINCER

General summary.—The first part of the month over the northern section of the country was generally unfavorable for outdoor work and seasonal farm operations made little progress. The frequent snows during this period hampered movement of crops to market, but they were favorable in protecting the grain fields against the cold waves which overspread northern areas. In the South, however, the weather permitted farm work to proceed practically unimpeded and winter crops and outdoor operations made good advance.

About the middle of December precipitation was heavy over some eastern districts, but more moisture was still generally needed in most southeastern areas. In the northwest a continuation of cold weather and high winds was unfavorable for livestock, but the frozen ground in the interior valley States made conditions better for gathering the corn that was still out.

Toward the latter part of the month precipitation was was heavy and in some places excessive over the lower Ohio and Mississippi Valleys, with much flooding, and much sleet and glaze was reported from the upper Ohio Valley and Lake region. Rains were beneficial in the Middle Atlantic States, but elsewhere the heavy precipitation prevented seasonal farm operations and caused some local damage. A good snow cover for winter grains and grass wasreported from most sections and much of the western range was covered. The coldest weather of the season was experienced in some parts of the Great Basin and some injury by cold was indicated from the South.

Small grains.—In the more northern districts east of the Great Plains winter wheat was generally well protected by snow during most of December, but in some western sections the ground was mostly bare. The absence of a good snow cover during the cold wave the second week caused some anxiety, but apparently no material harm resulted. In the southwestern sections of the Wheat Belt there was a continued absence of moisture and some injury resulted to the crop by drifting soil. The mostly mild weather in the South was generally favorable for winter grain crops.

Corn.—During the first part of the month husking and cribbing corn made slow progress due to the continued wet fields and mostly unfavorable weather. There was considerable of this work remaining to be done and husking did not get well under way until the third week, when frozen ground facilitated operations. Cribbing was